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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 09/820,710      | 03/30/2001  | Takashi Kato         | 684.3166            | 4478             |

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FITZPATRICK CELLA HARPER & SCINTO  
30 ROCKEFELLER PLAZA  
NEW YORK, NY 10112

EXAMINER

AMARI, ALESSANDRO V

| ART UNIT | PAPER NUMBER |
|----------|--------------|
|----------|--------------|

2872

DATE MAILED: 03/21/2002

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Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/820,710

Applicant(s)

KATO ET AL.

Examiner

Amari, Alessandro V.

Art Unit

2872

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-16 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-5,10,13,15 and 16 is/are rejected.
- 7) ☒ Claim(s) 6-9,11,12 and 14 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 4,6.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

### *Claim Objections*

1. Claims 7, 8, 9, 11, 12 and 13 are objected to because of the following informalities:

Regarding claim 7, line 4 the phrase "said reflection mirror" lacks proper antecedent basis. Appropriate correction is required.

2. Claim 14 is objected to under 37 CFR 1.75(c) as being in improper form because a multiple dependent claim cannot depend from any other multiple dependent claim. See MPEP § 608.01(n). Accordingly, the claim 14 has not been further treated on the merits.

### *Claim Rejections - 35 USC § 102*

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1-3 are rejected under 35 U.S.C. 102(b) as being anticipated by Chen U.S. Patent 5,287,218.

In regard to claim 1, Chen discloses (see Figure 5) a projection optical system, comprising: at least one lens (50); at least one concave mirror (22, 24); and at least one diffractive optical element (72).

Regarding claim 2, Chen discloses that said at least one lens, said at least one concave mirror (see column 2, lines 61-62 and 65) and said at least one diffractive

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optical element have a positive refractive power (as described in column 3, lines 48-50), respectively, and wherein said projection optical system does not include a lens having a negative refractive power, a mirror having a negative refractive power or a diffractive optical element having a negative refractive power.

Regarding claim 3, Chen discloses that said at least one lens, said at least one concave mirror and said at least one diffractive optical element include a lens, a concave mirror and a diffractive optical element of a positive refractive power as described in column 2, lines 61-62 and 65 and column 3, lines 48-50.

5. Claims 15 and 16 are rejected under 35 U.S.C. 102(b) as being anticipated by Kuba U.S. Patent 5,623,365.

In regard to claim 15, Kuba discloses a device manufacturing method, comprising the steps of exposing a wafer to a device pattern; and developing the exposed wafer as described in column 1, lines 7-25.

Regarding claim 16, Kuba discloses that the exposure step uses laser light from one of an ArF excimer laser and an F2 excimer laser as described in column 3, lines 31-35.

### ***Claim Rejections - 35 USC § 103***

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 1, 3, 4 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takahashi U.S. Patent 5,691,802 in view of Kuba U.S. Patent 5,623,365.

In regard to claims 1, 3, 4 and 10, Takahashi teaches (see Figure 3) a projection optical system comprising: at least one lens ( $G_{13F}$ ); at least one concave mirror ( $M_1$ ). Regarding claim 3, Takahashi also teaches that said at least one lens, said at least one concave mirror and that the lens, and concave mirror have a positive refractive power as described in column 3, lines 4-8. Regarding claim 4, Takahashi teaches (see Figure 3) said projection optical system includes a first imaging optical system ( $G_1$ ) having said at least one lens ( $G_{13F}$ ) and said at least one concave mirror ( $M_1$ ), for imaging an intermediate image of an object, and a second imaging optical system ( $G_2$ ) having said at least one lens ( $G_{21}$ ). Regarding claim 10, Takahashi further teaches (see Figure 3) a reflection surface ( $M_2$ ) disposed adjacent an intermediate image formed by said first imaging optical system, and wherein abaxial light (as shown by axis AX2) from the object as reflected and collected by said concave mirror is deflected by said reflection surface toward said second imaging optical system.

However, Takahashi does not teach the projection optical system with at least one diffractive optical element having a positive diffractive power.

In regard to claims 1 and 4, Kuba does teach (see Figure 6) a projection optical system incorporating at least one diffractive element (11) and regarding claim 3, the diffractive optical element having a positive refractive power as described in column 3, lines 4-8 and column 4, lines 1-5.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate the diffractive optical element of Kuba in the projection optical system of Takahashi in order to effectively correct for chromatic aberration.

8. Claims 1, 3, 4, 5, 10 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takahashi U.S. Patent 5,691,802 in view of Chen U.S. Patent 5,287,218.

In regard to claims 1, 3, 4, 5, 10 and 13, Takahashi teaches (see Figure 3) a projection optical system comprising: at least one lens ( $G_{13F}$ ); at least one concave mirror ( $M_1$ ). Regarding claim 3, Takahashi also teaches that said at least one lens, said at least one concave mirror and that the lens, and concave mirror have a positive refractive power as described in column 3, lines 4-8. Regarding claim 4, Takahashi teaches (see Figure 3) said projection optical system includes a first imaging optical system ( $G_1$ ) having said at least one lens ( $G_{13F}$ ) and said at least one concave mirror ( $M_1$ ), for imaging an intermediate image of an object, and a second imaging optical system ( $G_2$ ) having said at least one lens ( $G_{21}$ ). Regarding claim 10, Takahashi further teaches (see Figure 3) a reflection surface ( $M_2$ ) disposed adjacent an intermediate image formed by said first imaging optical system, and wherein abaxial light (as shown by axis AX2) from the object as reflected and collected by said concave mirror is deflected by said reflection surface toward said second imaging optical system.

In regard to claims 1 and 3, Takahashi does not teach a diffractive optical element having appositve diffractive power. Also, regarding claim 4, Takahashi does

not teach a second imaging optical system having at least one diffractive element.

Regarding claim 5, Takahashi does not teach said first and second imaging optical systems are disposed along a common straight optical axis, and wherein abaxial light from the object as reflected and collected by said concave mirror is caused by said mirror to pass through an outside portion of an effective diameter of said concave mirror, toward the image plane side. Regarding claim 13, Takahashi does not teach a field stop adjacent an intermediate image to be formed by said first imaging optical system.

However, in regard to claim 1, Chen does teach an optical system comprising at least one diffractive optical element (72 in Figure 5).

Regarding claim 3, Chen does teach that the diffractive optical element has positive refractive power as described in column 3, lines 48-50.

Regarding claim 4, Chen teaches at least one diffractive optical element for projecting the intermediate image onto an image plane as shown in the bottom half of Figure 5.

Regarding claim 5, Chen teaches that said first and second imaging optical systems are disposed along a common straight optical axis, and wherein abaxial light from the object as reflected and collected by said concave mirror is caused by said mirror to pass through an outside portion of an effective diameter of said concave mirror, toward the image plane side as shown in the bottom half of Figure 5.

Regarding claim 13, Chen further teaches (see Figure 5) a field stop (20) adjacent an intermediate image to be formed by said first imaging optical system.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate the diffractive optical element as taught by Chen in the projection optical system of Takahashi in order to effectively correct for chromatic aberration.

***Allowable Subject Matter***

9. Claims 6-9 and 11-12 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

10. Claim 6 is allowable over the prior art for at least the reason that the prior art fails to teach or reasonably suggest "a field optical system disposed between said first and second imaging optical systems" as set forth in the claimed combination.

Claim 7 is allowable over the prior art for at least the reason that the prior art fails to teach or reasonably suggest "said first imaging optical system includes at least a lens having a positive refractive power, said reflection mirror and said concave mirror, which are disposed in the order mentioned above, from the object side " as set forth in the claimed combination.

Claim 11 is allowable over the prior art for at least the reason that the prior art fails to teach or reasonably suggest "at least one of diffractive optical elements of said projection optical system satisfies a relation:  $3 < MP/\lambda < 50$  where MP is a minimum pitch (micron) of the diffractive optical element, and  $\lambda$  is the exposure wavelength (micron)" as set forth in the claimed combination.



Claim 12 is allowable over the prior art for at least the reason that the prior art fails to teach or reasonably suggest "at least one of diffractive optical elements of said projection optical system satisfies a relation:  $|L_d/L_{g2}| < 0.2$  where  $L_d$  is the distance between an aperture stop of said second imaging optical system and said diffractive optical element, and  $L_{g2}$  is the distance from an paraxial image plane position of an intermediate image formed by said first imaging optical system, corresponding to an object point position of said second imaging optical system, to an re-imaging plane where the intermediate image is reimaged" as set forth in the claimed combination.

The prior art of record, Takahashi, Kuba and Chen teach a projection optical system with first imaging optical system with at least one lens, a concave mirror for imaging an intermediate image of an object and a second imaging optical system having at least one lens and an diffractive optical element for projecting the intermediate image onto an image plane. Furthermore, the combination discloses that the first and second imaging optical systems are disposed along a common straight optical axis, and wherein abaxial light from the object as reflected and collected by said concave mirror is caused by said mirror to pass through an outside portion of an effective diameter of said concave mirror, toward the image plane side. However, the combination does not disclose a field optical system disposed between said first and second imaging optical systems nor that the first imaging optical system includes at least a lens having a positive refractive power, said reflection mirror and said concave mirror, which are disposed in the order mentioned above, from the object side. Neither does the

combination that the diffractive optical elements in the system satisfy the  
aforementioned optical relationships.

11. Any inquiry concerning this communication or earlier communications from the  
examiner should be directed to Alessandro V. Amari whose telephone number is (703)  
306-0533. The examiner can normally be reached on Monday-Friday from 8:00 am to  
5:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's  
supervisor, Cassandra Spyrou can be reached on (703) 308-1687. The fax phone  
numbers for the organization where this application is assigned is (703) 308-7722.

Any inquiry of a general nature or relating to the status of this application or  
proceeding should be directed to the receptionist whose telephone number is (703) 308-  
0956.

ava *AVg*  
March 14, 2002



**Cassandra Spyrou**  
**Supervisory Patent Examiner**  
**Technology Center 2800**